OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **MINE FALLS POND** the program coordinators recommend the following actions.

Welcome to the New Hampshire Volunteer Lake Assessment Program! As you continue your participation in VLAP the database you create for your water body will help you track trends in lake quality and identify potential problems. As a rule of thumb, try to sample once per month during the summer. Other special sampling programs include monitoring for non-point sources of pollution to the lake, and more frequent, long-term sample collection to establish a complex data set of your lake's water quality. We understand that future sampling will depend upon volunteer availability, water monitoring goals, and funding. **Trend analysis is not feasible with only a few data points.** It can take a few years of data collection to obtain an adequate set of baseline data. Frequent and consistent sampling will ensure useful data for future analyses. Contact the VLAP Coordinator this spring to schedule our annual lake visit. If your group feels they need a refresher in sampling techniques, call us early to make an appointment. Please consult the Interpreting Data and Monitoring Parameters sections of this report when trying to understand data.

FIGURE INTERPRETATION

- Figure 1: This graph illustrates concentrations of chlorophyll-a, also a measure of algal abundance, in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The current data show a *highly irregular* in-lake chlorophyll-a trend throughout the summer. On July 11th and August 22nd chlorophyll-a concentrations were above nuisance levels, according to New Hampshire classifications. In the next years of sampling we will watch for this event to reoccur. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graph on this page shows current year data. The graph shows transparency was *fairly stable* throughout the summer. The lowest reading took place in August in conjunction with the high chlorophyll-a value. The highest reading occurred in September, at the time of the lowest chlorophyll-a concentration. Otherwise, clarity was not overly affected by the drastic fluctuations in chlorophyll-a. We can keep the pond from having even lower clarities in the future by continuing the stringent sampling program that the Mine Falls Pond volunteers conducted this summer. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figures 3 and 3a show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer), respectively. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show phosphorus levels are *extremely high* in Mine Falls Pond. The greatest epilimnetic values occurred at the beginning of July and at the end of August, which correspond with the chlorophyll-a trends. One monitor noted on July 11th that there was a heavy rainstorm the night before sampling. This would explain the elevated phosphorus values in the epilimnion. Runoff from the watershed can carry excess nutrients into the epilimnion. The August watercolor was noted as muddy, which may have had an effect on the values. The muddy color may have been influenced by the dominance of dinoflagellates and golden-brown algae at that time. The hypolimnetic phosphorus was highest at the beginning of August. We will be looking for any external sources of pollution over the next few years, and hopefully we will be able to combat these high phosphorus readings! One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- Upon looking at the wet weather sampling data, we would like to suggest that more wet weather samples be collected over the next few years. It is evident from the data that many nutrients are being added to the pond during rain events. Wet weather sampling is a good indication of where external sources of nutrients originate.

- Conductivity was high throughout the summer at every site (Table 6). Conductivity increases often indicate the influence of human activities on surface waters. Septic system leachate, agricultural runoff, iron deposits, and road runoff can all influence conductivity. It would be useful to uncover the reasons for high conductivity as we continue to monitor the pond. Total phosphorus (Table 8) and turbidity (Table 11) were also very high throughout the watershed. Again, increasing the wet weather sampling regime will help us determine the sources of pollutants and nutrients entering the pond.

- The process of decomposition in the sediments depletes dissolved oxygen on the bottom of the lake (Tables 9 and 10). As bacteria break down organic matter, they deplete oxygen in the water. When oxygen gets below 1 mg/L, phosphorus normally bound up in the mud may be released into the water column, a process that is referred to as *internal loading*. Depleted oxygen in the hypolimnion usually occurs as the summer progresses. This explains the higher phosphorus in the hypolimnion (lower water layer) versus the epilimnion (upper layer). Since an internal source of phosphorus to the lake is present, limiting or eliminating external phosphorus sources in the lake's watershed is even more important for lake protection. Oxygen saturation was high in the beginning of the summer in the top layer of the lake, but gradually declined as the summer progressed.

NOTES

- Monitor's Note (6/13/00): No dissolved oxygen profile; batteries failed. Water color at deep spot clear, but green and cloudy at edge. Day before sampling-56°F, rainy.

- Monitor's Note (6/27/00): A few floating islands of filamentous algae in area of sample station; some attached to our buoy. Previous 3 days weather-hazy, hot, and humid.

- Monitor's Note (7/11/00): Sunday, heavy evening rain.

- Monitor's Note (7/25/00): Samples left unrefrigerated for 3 hours. Water tea colored.

- Monitor's Note (8/8/00): Rainy, cloudy day before, 80s.

- Monitor's Note (9/5/00): Lots of floating algae mats. Saturday rainy.

- Monitor's Note (9/19/00): Cloudy water color.

USEFUL RESOURCES

A Brief History of Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

Effects of Phosphorus on New Hampshire's Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

Anthropogenic Phosphorus and New Hampshire Waterbodies, NHDES-WSPCD-95-6, NHDES Booklet, (603) 271-3503

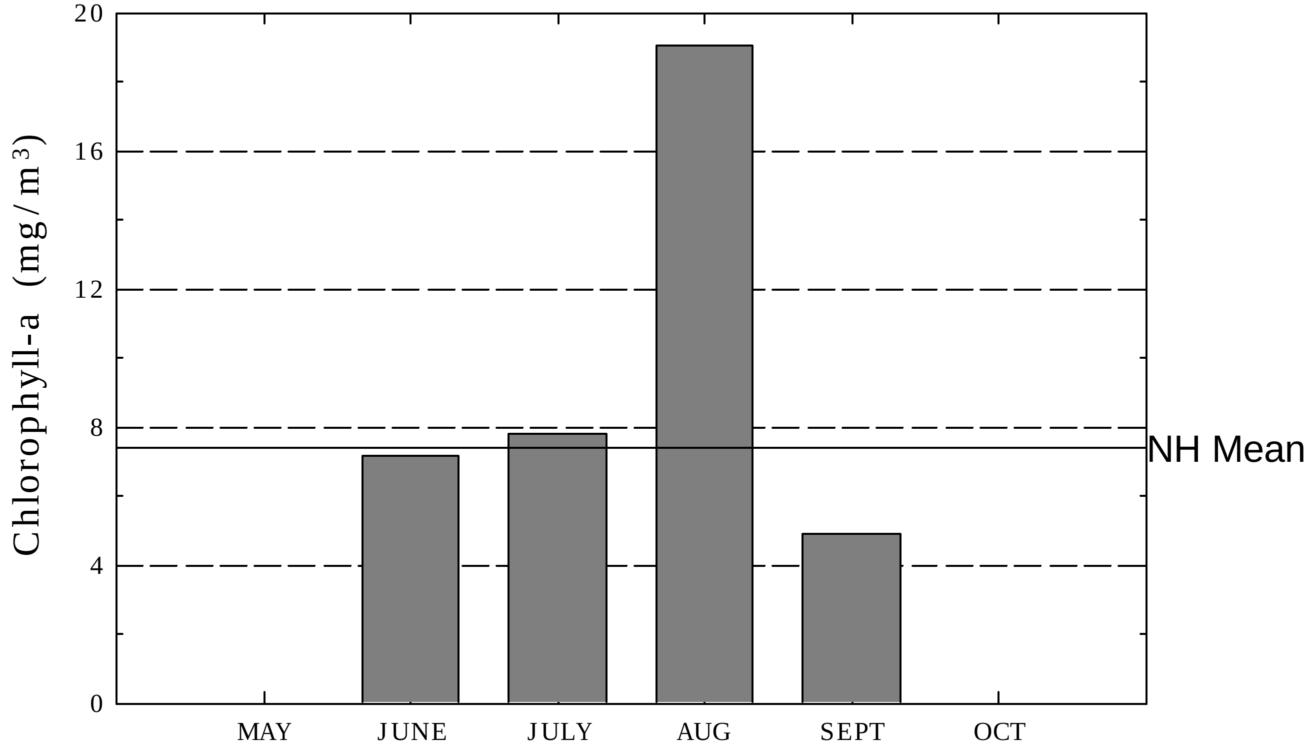
Nonpoint Source Pollution and Stormwater Fact Sheet Package. Terrene Institute. (703) 661-1582.

The Watershed Guide to Cleaner Rivers, Lakes, and Streams, Connecticut River Joint Commissions, 1995. (603) 826-4800

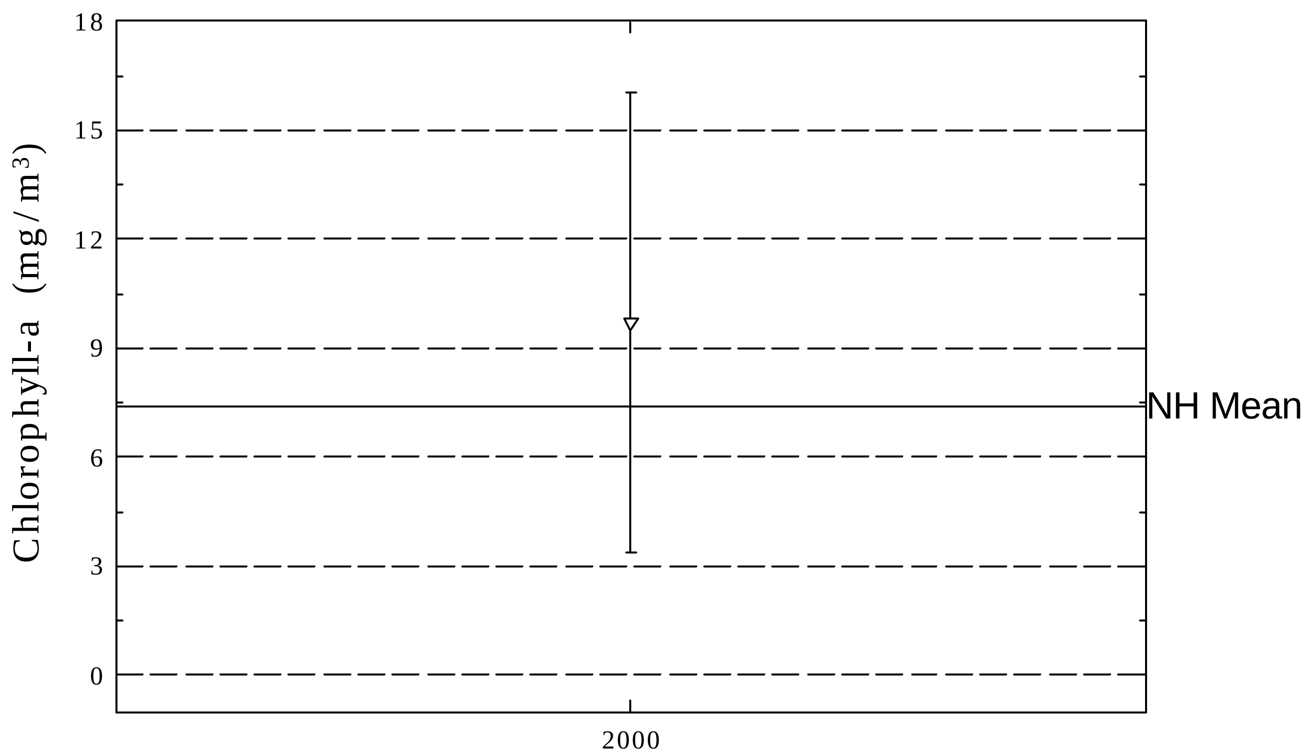
The Blue Green Algae. North American Lake Management Society, 1989. (608) 233-2836 or www.nalms.org

Mine Falls Pond

Figure 1. Monthly and Historical Chlorophyll-a Results



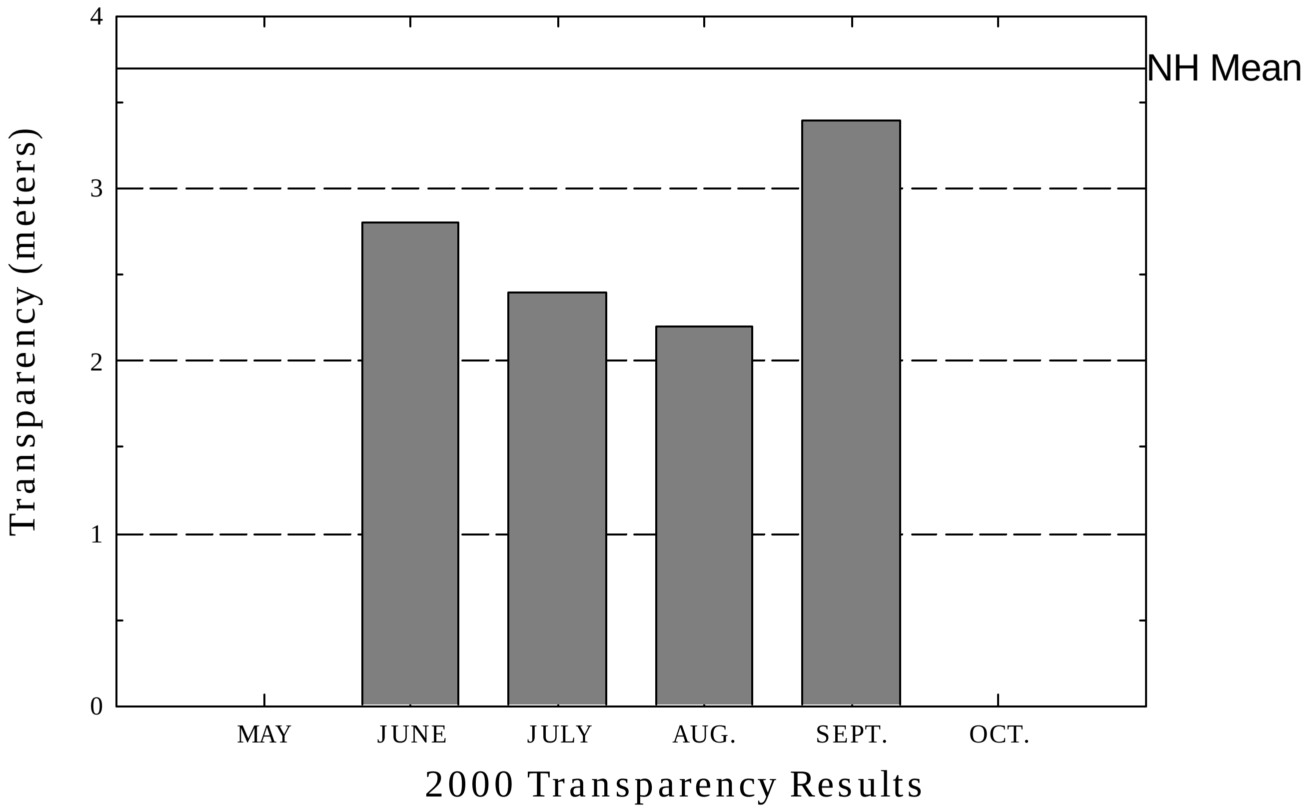
2000 Chlorophyll-a Results

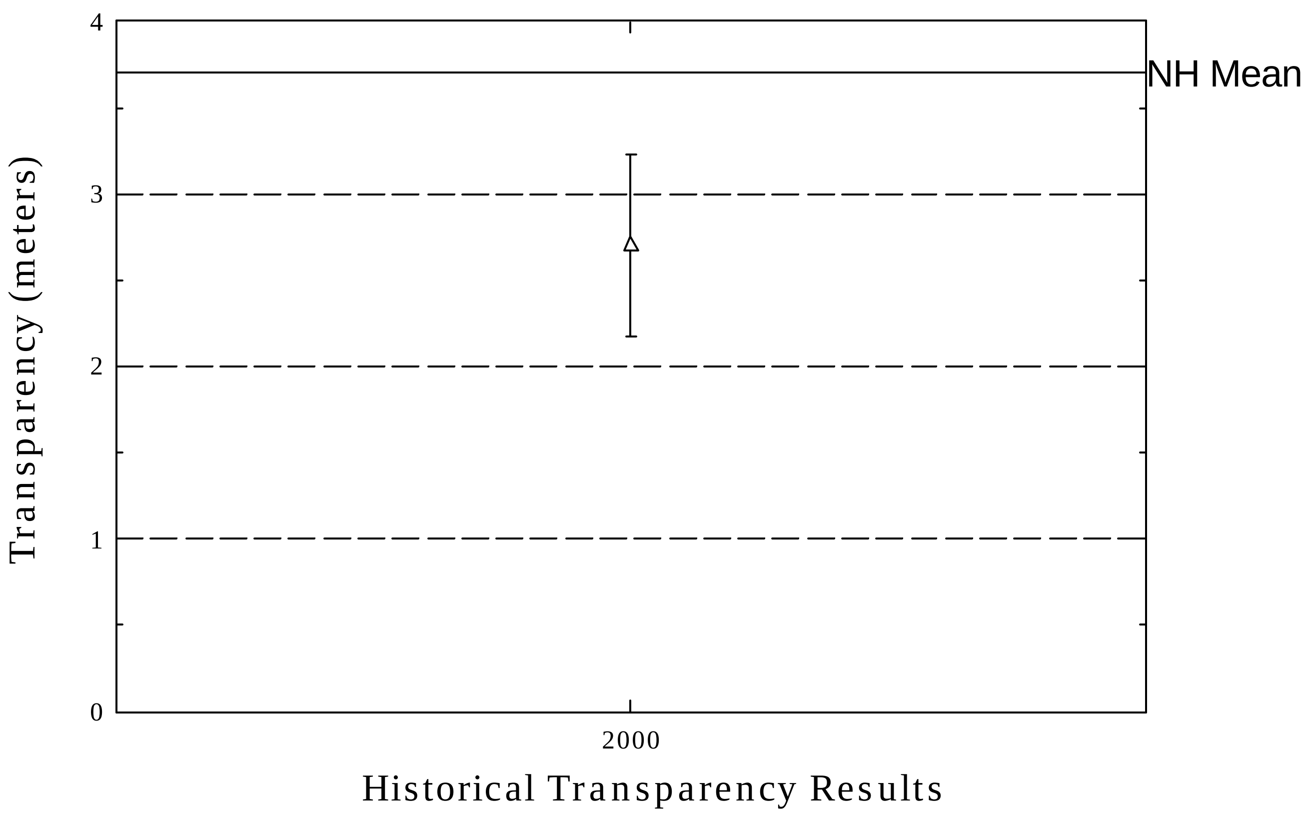


Historical Chlorophyll-a Results

Mine Falls Pond

Figure 2. Monthly and Historical Transparency Results





Mine Falls Pond

Figure 3. Monthly and Historical Total Phosphorus Data.

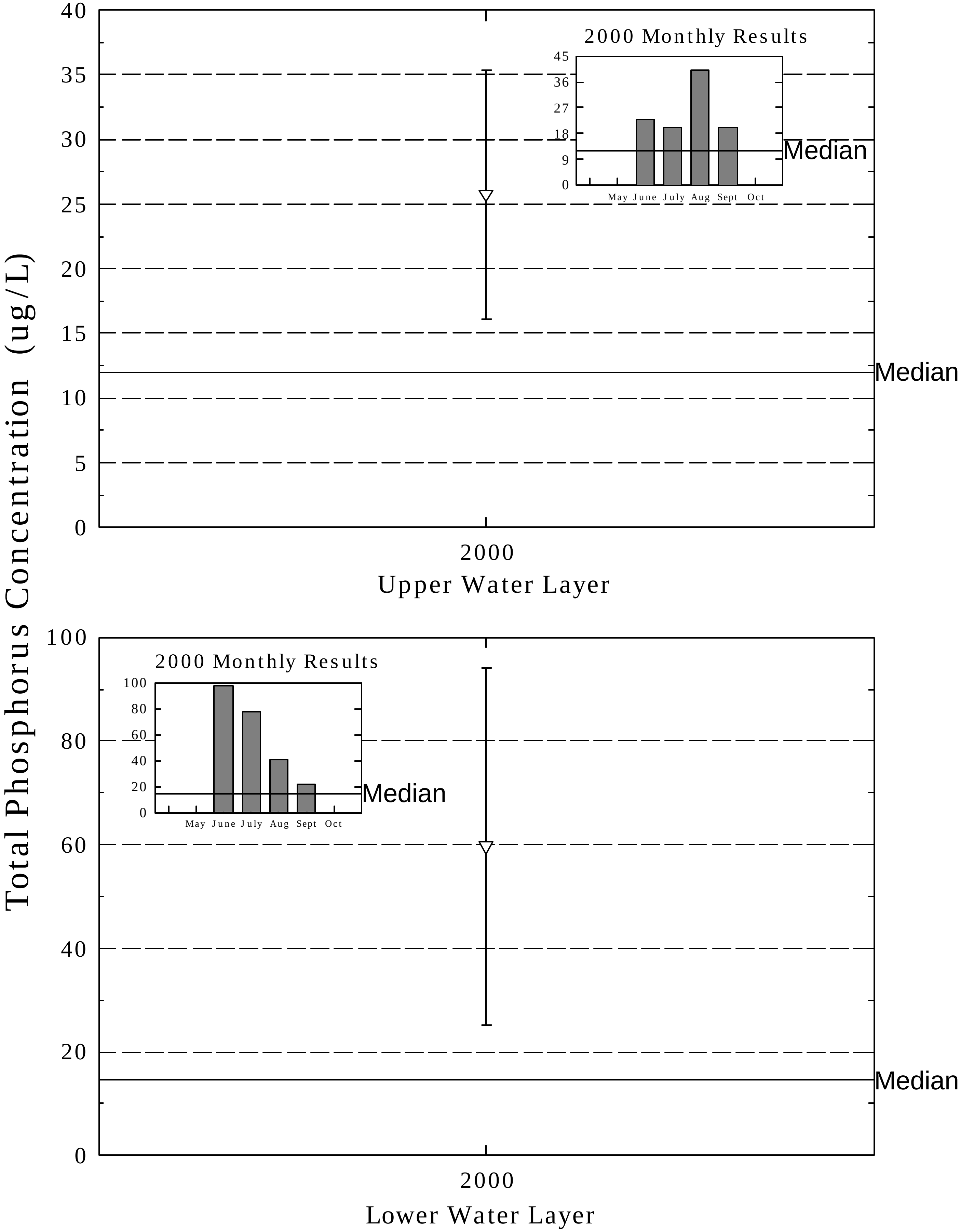


Table 1.

MINE FALLS POND

NASHUA

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
2000	4.91	28.71	12.17

Table 2.

MINE FALLS POND

NASHUA

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
06 / 27 / 2000	CERATIUM	56
	MALLOMONAS	33
	ASTERIONELLA	8
07 / 11 / 2000	CERATIUM	70
	PERIDINIUM	12
	MALLOMONAS	8
07 / 25 / 2000	CERATIUM	98
	SYNURA	1
	FRAGILARIA	1
08 / 08 / 2000	CERATIUM	58
	ASTERIONELLA	26
	RHIZOSOLENIA	6
08 / 22 / 2000	ASTERIONELLA	25
	CERATIUM	21
	RHIZOSOLENIA	13
09 / 05 / 2000	CERATIUM	43
	ASTERIONELLA	21
	DINOBRYON	20
09 / 19 / 2000	ASTERIONELLA	35
	CERATIUM	32
	DINOBRYON	16

Table 3.

MINE FALLS POND

NASHUA

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
2000	2.2	3.4	2.7

Table 4.

MINE FALLS POND
NASHUA

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
DW SITE 1				
	2000	6.77	7.40	7.00
DW SITE 4				
	2000	6.72	7.12	6.91
DW SITE 5				
	2000	6.91	7.22	7.03
DW SITE 6				
	2000	6.80	7.24	6.96
EPILIMNION				
	2000	6.30	7.49	6.81
HYPOLIMNION				
	2000	6.26	7.03	6.44
SITE #2- WET WEATHER				
	2000	7.09	7.09	7.09
SITE#1- WET WEATHER				
	2000	7.46	7.46	7.46
SITE#5- WET WEATHER				
	2000	6.43	6.43	6.43

Table 4.

MINE FALLS POND
NASHUA

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
SITE#6- WET WEATHER				
	2000	4.66	4.66	4.66
WW SITE 1				
	2000	6.45	6.45	6.45
WW SITE 2				
	2000	6.02	6.02	6.02
WW SITE 3				
	2000	5.94	5.94	5.94
WW SITE 4				
	2000	6.11	6.11	6.11
WW SITE 5				
	2000	4.70	4.70	4.70
WW SITE 7				
	2000	4.32	4.32	4.32

Table 5.

MINE FALLS POND

NASHUA

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean

Table 6.

MINE FALLS POND
NASHUA

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
DW SITE 1				
	2000	164.6	289.0	238.3
DW SITE 4				
	2000	331.0	489.0	406.0
DW SITE 5				
	2000	316.0	508.0	403.2
DW SITE 6				
	2000	316.0	470.0	389.1
EPILIMNION				
	2000	310.0	775.0	420.3
HYPOLIMNION				
	2000	360.0	789.0	628.1
SITE #2- WET WEATHER				
	2000	301.0	301.0	301.0
SITE#1- WET WEATHER				
	2000	2.8	2.8	2.8
SITE#5- WET WEATHER				
	2000	55.6	55.6	55.6
SITE#6- WET WEATHER				
	2000	50.0	50.0	50.0
WW SITE 1				
	2000	5.2	5.2	5.2

Table 6.

MINE FALLS POND

NASHUA

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
WW SITE 2				
	2000	224.0	224.0	224.0
WW SITE 3				
	2000	130.5	130.5	130.5
WW SITE 4				
	2000	33.0	33.0	33.0
WW SITE 5				
	2000	56.7	56.7	56.7
WW SITE 7				
	2000	46.7	46.7	46.7

Table 8.

MINE FALLS POND
NASHUA

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
DW SITE 1				
	2000	47	93	70
DW SITE 4				
	2000	18	42	23
DW SITE 5				
	2000	13	17	15
DW SITE 6				
	2000	15	87	37
EPILIMNION				
	2000	20	54	30
HYPOLIMNION				
	2000	22	163	80
SITE #2- WET WEATHER				
	2000	276	276	276
SITE#1- WET WEATHER				
	2000	73	73	73
SITE#5- WET WEATHER				
	2000	196	196	196
SITE#6- WET WEATHER				
	2000	10	10	10
WW SITE 1				
	2000	526	526	526

Table 8.

MINE FALLS POND

NASHUA

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
WW SITE 2				
	2000	364	364	364
WW SITE 3				
	2000	196	196	196
WW SITE 4				
	2000	74	74	74
WW SITE 5				
	2000	85	85	85
WW SITE 7				
	2000	77	77	77

Table 9.

MINE FALLS POND
NASHUA

Current year dissolved oxygen and temperature data.

Depth (meters)	**Temperature** (celsius)	**Dissolved Oxygen** (mg/L)	**Saturation** (%)
	June 27, 2000		
0.1	25.0	9.1	110.0
0.1	25.0	9.1	110.0
1.0	24.0	8.5	100.0
1.0	24.0	8.5	100.0
2.0	20.0	11.7	127.0
2.0	20.0	11.7	127.0
3.0	16.9	11.9	118.0
3.0	16.9	11.9	118.0
4.0	14.0	0.2	2.0
4.0	14.0	0.2	2.0
4.5	14.3	0.2	2.0
4.5	14.3	0.2	2.0
	July 11, 2000		
0.1	23.1	9.3	108.0
0.1	23.1	9.3	108.0
1.0	23.1	9.2	107.0
1.0	23.1	9.2	107.0
2.0	22.6	6.2	71.0
2.0	22.6	6.2	71.0
3.0	19.1	12.5	133.0
3.0	19.1	12.5	133.0
4.0	15.8	0.3	3.0
4.0	15.8	0.3	3.0
	July 25, 2000		
0.1	23.7	9.3	108.0
0.1	23.7	9.3	108.0
1.0	23.6	9.3	108.0
1.0	23.6	9.3	108.0

Table 9.

MINE FALLS POND

NASHUA

Current year dissolved oxygen and temperature data.

Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
July 25, 2000			
2.0	23.0	6.7	77.0
2.0	23.0	6.7	77.0
3.0	20.7	7.0	77.0
3.0	20.7	7.0	77.0
4.0	17.0	0.6	6.0
4.0	17.0	0.6	6.0
August 22, 2000			
0.1	20.9	8.3	92.9
1.0	20.9	8.3	93.3
2.0	20.9	8.2	91.8
3.0	20.2	2.7	29.8
4.0	17.9	0.5	5.2
September 5, 2000			
0.1	21.5	5.0	56.0
1.0	21.5	4.9	54.0
2.0	21.3	4.6	51.0
3.0	20.7	0.7	7.0
4.0	18.4	0.2	3.0
September 19, 2000			
0.1	19.3	8.4	90.0
1.0	19.3	8.2	88.0
2.0	19.1	7.1	76.0
3.0	18.9	5.7	59.0
4.0	18.4	1.0	11.0

Table 10.

MINE FALLS POND

NASHUA

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
June 27, 2000	4.5	14.3	0.2	2.0
June 27, 2000	4.5	14.3	0.2	2.0
July 11, 2000	4.0	15.8	0.3	3.0
July 11, 2000	4.0	15.8	0.3	3.0
July 25, 2000	4.0	17.0	0.6	6.0
July 25, 2000	4.0	17.0	0.6	6.0
August 22, 2000	4.0	17.9	0.5	5.2
September 5, 2000	4.0	18.4	0.2	3.0
September 19, 2000	4.0	18.4	1.0	11.0

Table 11.

MINE FALLS POND

NASHUA

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
DW SITE 1				
	2000	0.6	1.8	1.1
DW SITE 4				
	2000	0.7	5.0	1.6
DW SITE 5				
	2000	0.4	2.9	1.0
DW SITE 6				
	2000	0.3	9.2	1.6
EPILIMNION				
	2000	0.9	26.0	4.2
HYPOLIMNION				
	2000	1.1	32.0	8.6
SITE #2- WET WEATHER				
	2000	10.7	10.7	10.7
SITE#1- WET WEATHER				
	2000	3.7	3.7	3.7
SITE#5- WET WEATHER				
	2000	2.5	2.5	2.5
SITE#6- WET WEATHER				
	2000	1.0	1.0	1.0
WW SITE 1				
	2000	28.0	28.0	28.0
WW SITE 2				

Table 11.

MINE FALLS POND

NASHUA

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
	2000	16.7	16.7	16.7
WW SITE 3				
	2000	15.6	15.6	15.6
WW SITE 4				
	2000	2.0	2.0	2.0
WW SITE 5				
	2000	5.7	5.7	5.7
WW SITE 7				
	2000	7.3	7.3	7.3